in this zone are tidal perennial aquatic habitat, tidal brackish emergent wetland, seasonal nontidal wetland, and grassland. The marsh is primarily a managed wetland, with levees to control water level and seasonal flooding with fresh water.

Historically, the eastern portion of Suisun Marsh was predominantly tidal fresh and brackish water marsh. The western portion of the marsh was predominately fresh and brackish marshland with more saline marsh existing on the western edge. Within these broad marshes were sloughs, channels, ponds, and small bays. Except for parts of Suisun Bay, the segment had relatively few tidal flats. Large areas of moist grasslands connected the baylands with upland areas (Goals Project 1999).

An extensive network of sloughs conveys tidal flows and some freshwater flow into the marsh. Montezuma Slough, the largest of these, is connected to Suisun Bay at its eastern and western ends. The slough is an important nursery area for many fish, including chinook salmon, striped bass, splittail, and delta smelt. The Suisun Marsh Salinity Control Structure was constructed near the eastern slough entrance and began operation in the fall of 1988 to limit the tidal influx of saltwater from the Bay into Suisun Marsh. The salinity control structure operates from September through May by closing during flood tides and opening during ebb tides to keep salinity in the slough low throughout the managed wetland flooding season.

Efforts in the 1970s resulted in protecting the Suisun Marsh, the largest remaining brackish marsh in California. The marsh is an extremely important resource for migratory waterfowl, associated wildlife (including several threatened and endangered species), and many fish species. The marsh also harbors sensitive plant species and communities including several rare species. The Suisun thistle is a Suisun endemic and is found nowhere else in the world. The Suisun Marsh Protection Plan played a key role in reducing development pressure and other adverse impacts associated with human disturbance, such as accidental fires, careless application of pesticides and herbicides, and urban runoff.

NAPA RIVER ECOLOGICAL MANAGEMENT UNIT

The Napa River Ecological Management Unit is within the Napa River watershed and includes the river, an extensive marsh/slough complex, and the lower river estuary connecting to San Pablo Bay. Historically, this area was nearly all tidal salt marsh and tidal brackish marsh dominated by the flow patterns of the lower Napa River (Goals Project 1999). Currently, most of the baylands have been reclaimed for salt or agricultural production. A network of sloughs fringed by saline emergent marsh is also present. The sloughs have become silted as a result of lost tidal prism. The baylands are surrounded by uplands composed primarily of grasslands which are rapidly being converted to urban and agricultural (vineyard) uses. In the north, natural upper river watershed habitats have been reduced by agricultural and urban development and flood control measures. Vernal pools and other seasonal wetland habitats characteristic of the upper watershed have been almost entirely eliminated in the Napa River Ecological Management Unit.

The Napa River historically consisted of a fairly broad riparian corridor and programs to restore riparian and shaded riverine aquatic habitat will be an important component of the program, particularly in the upper Napa River area to provide habitat for wildlife and aquatic habitat for fish species. The tidal marshes of this area are of limited size and habitat quality due to past reclamation. Remaining tidal marshes are linear with little channel development. The larger sloughs have silted up due to a reduced tidal prism.

SONOMA CREEK ECOLOGICAL MANAGEMENT UNIT

The Sonoma Creek Ecological Management Unit is located southwest of the Napa River Ecological Management Unit. The main habitat types in the area are tidal and seasonal marsh, tidal sloughs, and upland areas, such as vernal pools, grassland, and savanna. Historically, this area was nearly all tidal salt marsh and tidal brackish marsh. Some areas of moist grasslands existed to the north and west along upper Sonoma Creek and in the drainages surrounding Lake Tolay (Goals Project 1999).

The lower portions of the unit are baylands, composed of tidal sloughs with fringing marshes,

some diked managed wetlands, diked farm lands, mostly oat and hay, and surrounding uplands characterized by grasslands, vernal pools, and oak woodlands quickly being converted to vineyards. Tidal marshes and channels are reduced as a result of reclamation. Seasonal wetlands develop during the rainy season on reclaimed agricultural lands. Urban development along the upper river is associated with the city of Sonoma. Vineyards are the predominant land use in the upper watershed, particularly on the valley floor. The mountains of the watershed are characterized by oak woodlands, chaparral, and mixed conifer habitats. As in the Napa River Ecological Management Unit, much of the vernal pool, seasonal wetland and oak savanna habitat previously present on the valley floor has been eliminated as a result of agricultural and urban development.

Petaluma River Ecological Management Unit

The Petaluma River Ecological Management Unit is located west of the Sonoma Creek unit on the northwest margin of San Pablo Bay. The habitat types in this watershed are marsh wetlands and uplands, such as grassland. The lower portion of the watershed is composed of tidal marshes and sloughs, and diked seasonal wetlands and historic bayland which have been reclaimed for agriculture. Historically, tidal marsh was the dominant habitat type in this ecological management unit. Salt marsh existed near the mouth of the Petaluma River, and small tidal flats existed at the river mouth (Goals Project 1999).

The diked agricultural lands intermittently pond water during the rainy season which provided habitat for shorebirds and waterfowl. The surrounding uplands are characterized by open grasslands and oak savannas. This unit contains the largest extant natural tidal marsh on the west coast. The upper watershed is rapidly developing with Petaluma, the largest city. Agricultural uses include grazing, oat hay production, and vineyards.

San Pablo Bay Ecological Management Unit

The San Pablo Bay Ecological Management Unit includes San Pablo Bay and the adjacent mudflat and marsh baylands, both diked and non-diked. Habitat varies from deep bay marine habitat to edge mudflats and marsh/slough complexes. Bay habitat varies from nearly fresh water at its eastern end, during periods of high freshwater outflow, to nearly seawater salinity levels (32 parts per thousand) during the periods of lowest outflow at the western end of San Pablo Bay. Salinity in the bay is stratified (layered) during high outflow conditions, but is not stratified in dry periods/years. The mixing zone is upstream is San Pablo Bay in dry years.

Historically, this unit supported large tidal marshes that were bordered by extensive mudflats (Goals Project 1999). Although it is generally less productive than the less saline Suisun Bay to the east, San Pablo Bay is a productive estuary that has important spawning and rearing habitat for many marine, estuarine, and anadromous fish and marine-estuarine invertebrates (e.g., shrimp, crabs, and clams).

Vision for the Ecological Management Zone

The vision for the Suisun Marsh/North San Francisco Bay Ecological Management Zone includes the concept of "whole marsh management." This vision embodies key parameters needed to successfully restore ecological processes, habitats, and to restore, maintain, or recover a wide diversity of fish, wildlife, and plant species.

The Goals Project (1999) proposed a series of key considerations in restoration of the Suisun Marsh/North San Francisco Bay Ecological Management Zone. The considerations include:

- large, connected patches of tidal marsh habitat centered on existing populations of species concern (e.g., salt marsh harvest mouse, California clapper rail),
- placement of tidal marshes along the edge of the Bay an at the mouths of tributary streams to maximize benefits for aquatic organisms,
- incorporating natural features such as large tidal channels, marsh ponds, transitional pannes, and beaches to optimize habitats for many species of fishes, shorebirds, and waterfowl,

- utilize managed saline and seasonal ponds near mudflats to provide high-tide habitat for shorebirds,
- provide natural habitat transitions between bayland habitats and adjacent upland habitats to provide habitat required by many special status plant species,
- provide continuous corridors of riparian habitat along streams tributary to the Bay, and
- maintain upland buffers to protect all existing and restored wetland habitats from disturbance.

The vision for the Suisun Marsh/North San Francisco Bay Ecological Management Zone includes providing a more natural freshwater outflow pattern from the Delta in dry and normal rainfall years, restoring tidal and nontidal wetlands, restoring tidal perennial aquatic habitat, and screening unscreened and poorly screened diversions. These changes will assist in the recovery of special-status species and increase important fish, wildlife, and plant communities. Local and regional agency and stakeholder initiatives will help attain this vision.

The vision focuses on improving the natural freshwater inflow pattern to San Francisco Bay and restoring important, tidally influenced aquatic and wetland habitats and adjacent uplands. Other focal points are reducing stressors, such as non-native marine invertebrates in ship ballast water and contaminants in municipal, industrial, and agricultural discharges into the Bay, and reducing losses of juvenile fish and their food organisms at unscreened diversions. Habitat improvements will benefit the salt marsh harvest mouse, Suisun song sparrow, California clapper rail, and California black rail, as well as many native waterfowl and wildlife species living in and around the North Bay. Improving freshwater inflow and habitat will benefit delta smelt, splittail, chinook salmon, striped bass, longfin smelt, and other anadromous and resident marine and estuarine fishes and larger marine invertebrates (e.g., shrimp, crabs, and clams) of the Bay, as well as the estuarine foodweb (e.g., algae and planktonic and bottom-dwelling animals) on which the fish depend. Separate visions have been prepared for many of these processes, stressors, habitats, and species. Volume I contains additional detail on the status and restoration needs of these resource elements and the specific restoration approach.

The vision for the Suisun Marsh/North San Francisco Bay Ecological Management Zone is closely tied to the vision for the Sacramento-San Joaquin Delta Ecological Management Zone. It is indirectly related to visions for the mainstem rivers and tributary watersheds. Flows and habitats in these areas are integrally linked. Many important anadromous fish and waterfowl species that use the Central Valley are affected by conditions in multiple Ecological Management Zones.

Restoring Suisun Marsh and North San Francisco Bay will improve the natural production of marine, estuarine, and anadromous fish; resident wildlife; migratory waterfowl; other winter migrants and neotropical birds; and special-status plants, plant communities, and associated terrestrial invertebrates. Several waterfowl species whose populations have declined in recent times, such as the canvasback and redhead, should also benefit.

Improving Suisun Marsh and North San Francisco Bay health will help to achieve the restoration goals set for the Sacramento-San Joaquin Delta Ecological Management Zone. Likewise, improving conditions in the Sacramento-San Joaquin River Delta (Delta) will benefit the Bay.

Goals for the Suisun Marsh/North San Francisco Bay Ecological Management Zone include protecting and enlarging remaining areas of native habitat and establishing connectivity among these areas. Enlarging the San Francisco Bay and San Pablo Bay National Wildlife Refuges and other State and local wildlife areas; expanding restoration efforts in the Napa Marsh area, Petaluma Marsh, and Sonoma baylands; and restoring connectivity among these features will help achieve the vision for this Ecological Management Zone. Expanding restoration efforts in the northeastern portion of Suisun Marsh and restoring connectivity with areas such as the Jepson Prairie Preserve in the Yolo Basin Ecological Management Zone and the Sacramento-San Joaquin Delta Ecological Management Zone will also contribute to this effort.

Potentially high-quality spawning, rearing, and migrating habitat will be restored to benefit important fish species that use Suisun Marsh and the Bay during at least a portion of their lives. This effort includes improving freshwater inflow patterns, particularly in dry and normal water years, and

restoring extensive areas of tidal aquatic and wetland habitats in Suisun Marsh and the Bay.

VISIONS FOR ECOLOGICAL MANAGEMENT UNITS

SUISUN BAY AND MARSH ECOLOGICAL MANAGEMENT UNIT

The vision for the Suisun Bay and Marsh Ecological Management Unit is to restore tidal marsh and to restore and enhance managed marsh, riparian forest, grassland, and other habitats.

Efforts and opportunities to restore tidal action to selected managed wetlands and promote natural riparian and wetland succession in Suisun Marsh will be expanded. Shallow-water, wetland, and riparian habitats within the marsh and along the shorelines of the Bay will be protected and improved, where possible. Upland habitats adjacent to riparian and wetland habitats will also be protected and improved. Efforts will focus on increasing the acreage open to tidal flows (e.g., by removing or opening levees) and providing connectivity among habitat areas to aid in the recovery of species, such as the salt marsh harvest mouse, clapper rail, and black rail. Those habitat areas will provide essential shelter and nesting cover during high tides. Improving marsh and slough habitats will benefit chinook salmon, striped bass, delta smelt, splittail, and other estuarine resident fish in the marsh and Suisun Bay.

Diverting water from Suisun Marsh channels for managed nontidal wetlands and controlling the salinity of water entering the marsh through Montezuma Slough will continue, but with consideration for maintaining the natural hydrologic regime and salinity levels of the slough and marsh. Efforts to screen diversions in the marsh will also continue to minimize the entrainment of juvenile fish. Water quality standards specified in the 1995 Water Quality Control Plan will be met in the eastern marsh and at several locations in the central marsh. Flows into the northwestern marsh will be improved.

Water diversions from Suisun Bay for cooling at the Pittsburg power plant will be conducted with minimal adverse effects on eggs, larvae, and juvenile fish. New fish screening technology or alternative sources of cooling water (such as cooling towers) will be considered.

Oil refinery operations in the Bay will be modified to reduce discharges of high levels of contaminants, such as selenium.

Suisun Marsh and Suisun Bay will function as high-quality spawning and rearing habitat and an effective fish migration corridor. A healthy Suisun Marsh-Bay ecosystem will be an important link in the estuary foodweb by improving primary and secondary productivity. Marsh and Bay productivity will improve as freshwater inflow events increase in dry and normal years and acreage of tidal wetlands and associated tidal perennial aquatic habitat increases.

NAPA RIVER ECOLOGICAL MANAGEMENT UNIT

The vision for the Napa River Ecological Management Unit is to restore large areas of tidal marsh to benefit salt marsh harvest mouse and California clapper rail; manage inactive salt ponds to benefit waterfowl; restore a continuous band of tidal marsh along the bayshore to benefit fish species; improve tidal circulation; manage diked wetlands and seasonal wetlands to improve seasonal ponding for shorebirds, wading birds and waterfowl; enhance riparian vegetation and marsh/upland transitional habitats; and provide upland buffers.

Restoration efforts will be focused in the Napa Marsh Wildlife Area, Cullinan Ranch, and Scagg Island. Habitats should be protected and natural expansion and succession should be supported to restore large, contiguous (connected) areas of tidal saline emergent wetland, riparian, and upland habitats. The existing habitat areas are sparse and low quality, because dikes and levees have disrupted the natural tidal flows and sediment supply that are essential to maintain marsh habitat. Restoring tidal action to additional portions of the marsh and improving water quality will enhance the health of the marsh. This, in turn, will aid in the recovery of species, such as the salt marsh harvest mouse and clapper rail in the southern part of the Ecological Management Unit. Fish species, such as chinook salmon, striped bass, splittail, and delta smelt, will benefit from the improved health of the marsh and associated improvements in the tidal slough complex and lower river estuary.

Sonoma Creek Ecological Management Unit

The vision for the Sonoma Creek Ecological Management Unit is to restore large patches of tidal marsh along the entire shoreline of San Pablo Bay; restore tidal marsh along Sonoma Creek; establish managed marsh or enhanced seasonal pond habitat for shorebirds; enhance riparian habitat along Sonoma Creek; and enhance marsh/upland transitional habitats.

Existing habitat will be maintained, and current and future restoration efforts in Napa/Sonoma Marsh will be expanded. The marsh is sparse and low quality, because dikes and levees have disrupted the natural sediment supply essential for maintaining marsh habitat. Leveed, historic marshland will be opened to tidal action, creating larger, more contiguous marsh areas. An expanded marsh/slough complex will support greater salt marsh harvest mouse and clapper rail populations, as well as splittail, delta smelt, juvenile chinook salmon, and striped bass. Restoration of existing managed marshlands may not be desirable as these lands support significant numbers of shorebirds and waterfowl. To achieve the restoration objective, acquisition and restoration of other diked baylands may be required.

Petaluma River Ecological Management Unit

The vision for the Petaluma River Ecological Management Unit is to restore a continuous band of tidal marsh along the bayshore from Tolay Creek to the Petaluma River; restore tidal marsh along the Petaluma River; establish managed marsh or enhanced seasonal pond habitat on agricultural baylands not restored to tidal habitat; protect moist grasslands; enhance riparian vegetation and marsh/upland transitional habitats; and to provide upland buffers and provide natural transitional habitat between marshes and upland areas.

Petaluma Marsh and its associated tidal slough network will be expanded. Outside of Petaluma Marsh, marsh habitat areas are sparse and low quality, because dikes and levees have disrupted the natural tidal flow and sediment supply essential for maintaining tidal emergent wetland habitat.

San Pablo Bay Ecological Management Unit

The vision for the San Pablo Bay Ecological Management Unit is to restore tidal marsh along the bayshore and to establish managed marshes or enhance seasonal pond habitat on agricultural baylands not restored to tidal action.

The ecological health of San Pablo Bay and its function as an important nursery area for marine, estuarine, and anadromous fish can be improved by increasing freshwater inflow in spring during years with low and normal freshwater outflow, protecting and expanding tidal marsh/slough habitat complexes along the margins of the bay, and reducing the input of pollutants into the bay. Removing dikes and levees along the bay's shoreline, where appropriate, will aid in the recovery and expansion of tidal emergent wetland habitat.

Visions for Ecological Processes

Central Valley Streamflows: A healthy pattern of freshwater inflow to Suisun Marsh and the North Bay would involve natural late-winter and spring flow events that support ecological processes and functions essential to the health of important Bay-Delta fish populations. Inflow to the Bay is impaired in dry and normal water years by storage and diversion of natural inflow to basin watersheds. The need for inflow to the Bay coincides with the need for natural flows in the mainstem rivers, their tributaries, and the Delta.

Natural Floodplain and Flood Processes: Expansion of the North Bay floodplain by setting back or removing levees would enhance floodwater and sediment retention and provide direct and indirect benefits to fish and wildlife that depend on natural floodplain inundation. Such floodplain expansion should also help to alleviate the flooding potential in other areas of the Bay-Delta.

Bay-Delta Aquatic Foodweb: The aquatic foodweb of the Delta, which supports important resident and anadromous fish, has been severely impaired by drought, reductions in freshwater flow, water diversions, introductions of non-native species (e.g., Asiatic clams), and loss of shallow water and

wetland habitats. Proposed improvements in spring flows, channel hydraulics, wetland habitats, and floodplain inundation should lead to a healthier and more productive aquatic foodweb. Improved water quality and greater sediment retention in wetland, riparian, and floodplain habitats will also increase foodweb productivity.

Visions For Habitats

Tidal Perennial Aquatic Habitat: Aquatic habitat within and associated with tidal wetland habitat is important to fish populations that use the Bay. The area of such habitat has been substantially reduced over the past century by land reclamation. Large areas of tidal habitat have been diked and reclaimed for agriculture, salt production, industry, nontidal wetlands (e.g., duck clubs), and other uses. Restoring large areas of presently leveed land to tidal influence may increase important fish species production by providing more spawning, feeding, and migrating habitat and increasing foodweb production throughout the Bay.

Nontidal Perennial Aquatic Habitat: Open water habitats in managed wetlands, such as ponds, provide valuable waterfowl and wildlife habitats. Such habitat should be included in restoration efforts involving nontidal saline emergent wetlands.

Tidal Sloughs: Sloughs are an important native habitat for fish and wildlife. Many slough complexes in the wetlands along the North Bay have disappeared as a result of land reclamation and levee construction. Restoring tidal wetland-slough complexes will provide valuable habitat for fish, including chinook salmon, striped bass, delta smelt, and longfin smelt.

Saline Emergent Wetlands (Tidal): Tidal saline emergent wetland habitat in the Bay has been drastically reduced as a result of land reclamation. Such habitat is essential to estuary functions and the health of many fish, waterfowl, and wildlife species. Wetlands also enhance water quality in the Bay by filtering out sediments and contaminants.

Seasonal Wetlands: Seasonal wetlands in Suisun Marsh provide valuable wetland habitat for waterfowl and shorebirds, as well as other wildlife.

Vernal Pools: Vernal pools provide habitat for many listed plant and invertebrate species. Vernal pool protection and restoration will be closely linked to other actions related to restoring wetland, riparian, and adjacent upland habitats.

Riparian and Shaded Riverine Aquatic Habitat: Riparian and shaded riverine aquatic (SRA) habitats have been greatly reduced as a result of development along streams in areas above the lower marshes, sloughs, and Bay shorelines. Such habitat has value to many special-status plant and animal species. In addition, SRA habitat is important for juvenile chinook salmon and many other resident and anadromous fish using the Bay.

Essential Fish Habitat: The Suisun Marsh/North San Francisco Bay Ecological Management Zone has been identified as Essential Fish Habitat (EFH) based on the definition of waters currently or historically accessible to salmon (National Marine Fisheries Service 1998). Key features of EFH to maintain or restore in this ecological management zone include substrate composition; water quality; water quantity, depth and velocity; channel gradient and stability; food; cover and habitat complexity; space; access and passage; and flood plain and habitat connectivity.

Perennial Grasslands: Grasslands associated with wetland margins are important habitats for some special-status plant and wildlife species. Wetlands should be restored along with the associated aquatic and upland habitats.

Visions for Reducing or Eliminating Stressors

Water Diversion: Water diversions in North Bay watersheds, in Suisun Marsh, and upstream in the Delta and rivers affect freshwater flow in the Bay and remove fish and their foodweb organisms from the Bay. Unscreened diversions will be screened and poorly functioning screens will be improved to reduce fish loss. Where possible, diversions will be consolidated to reduce the number of diversions requiring screening. Most diversions in the Bay are confined to Suisun Marsh and Suisun Bay.

Invasive Species: Over the past several decades, the inadvertent introduction of many marine and estuarine organisms from the Far East in the ballast water of ships has greatly changed the plankton and

benthic invertebrate fauna of the Bay, with further consequences throughout the foodweb. Further changes can be expected if ballast water releases into the Bay are not restricted. Therefore, more stringent ballast water release restrictions are needed to reduce the influx of exotic species. Other invasive species such as exotic cordgrass (Spartina spp) are becoming established and control measures are needed to reduce future potential adverse affects. This vision incorporates the need to reduce the adverse impacts of already introduced species while seeking measures and opportunities to reduce or eliminate the impact from potential future introductions.

NON-NATIVE WILDLIFE: Reducing the numbers of non-native species and therefore the effects these species have on native wildlife will require a coordinated approach that includes restoring ecosystem processes and functions where applicable and possible, restoring native habitats, reducing or eliminating other stressors that suppress native species, and efforts to control non-native species.

PREDATION AND COMPETITION: Millions of chinook salmon and striped bass have been stocked in North Bay waters to improve the survival of these species and their contributions to spawning populations. Although the presence of these fish in the Bay could be considered natural, the stocking of millions of hatchery smolts into small areas of the North Bay within a short period may affect the survival and production of important Bay species, such as longfin smelt.

CONTAMINANTS: Toxic contaminants continue to enter the Bay in large amounts as a result of municipal, industrial, and agricultural discharges. These toxins have had a demonstrated adverse effect on the health, survival, and reproduction of many important Bay fish species and their foodweb organisms. Toxins in fish tissues also pose a health risk to people who eat fish from the Bay. Continuing to reduce levels of toxic contaminants from discharges and releases of toxins from sediment (i.e., disturbed by natural forces and dredging) is an essential step in the restoration program. The level of toxins in the Bay is also closely tied to inputs upstream in the Delta and rivers; therefore, efforts to improve water quality should be coordinated throughout the basin.

HARVEST OF FISH AND WILDLIFE: Legal and illegal fish harvest may limit recovery of some populations in the Bay-Delta system and its watersheds. Striped bass, salmon, steelhead, and sturgeon harvest in the Bay may affect the recovery of these populations.

DISTURBANCE: Human activity, particularly boat wakes in sloughs and channels in tidal wetland areas, disturbs nesting waterfowl and erodes habitat. Disturbance to the endangered California clapper rail which also may occur includes boating and hunting. Restricting boat speeds and access by motorized boats in special areas will reduce these stresses.

VISIONS FOR SPECIES

DELTA SMELT: The vision for delta smelt is to recover this State-and federally listed threatened species in order to contribute to the overall species richness and diversity of the Bay-Delta. Recovery of the delta smelt population in the Bay-Delta will occur through improved freshwater inflow and Delta outflow patterns, greater foodweb productivity, increased areas and quality of aquatic habitats, and reduced effects of water diversions. Higher delta smelt production should be apparent in dry and normal water year types in response to improved flows, habitats, and foodweb, and reductions in stressors.

LONGFIN SMELT: The vision for longfin smelt is to recover this California species of special concern in the Bay-Delta estuary so that it resumes its historical levels of abundance and its role as an important prey species in the Bay-Delta aquatic foodweb. Achieving consistently high production of longfin smelt in normal and wetter years, which historically produced more abundant juvenile populations (year classes), will be critical to the recovery of longfin smelt.

SPLITTAIL: The vision for splittail is to recover of this federally listed threatened species. Recovery of the Bay-Delta splittail population will occur through improved floodplain inundation, higher late-winter Delta inflow, and improved tidal aquatic and wetland habitats. Greater production of young would be expected in dry and normal water year types.

CHINOOK SALMON: The vision for Central Valley chinook salmon is to recover all stocks presently listed or proposed for listing under the State or federal ESAs, achieve naturally spawning population levels that support and maintain ocean commercial and ocean and inland recreational fisheries, and that use

fully existing and restored habitats. Central Valley salmon populations will remain stable or increase with improved late-winter and spring flows into and through the Delta, increases in wetland and floodplain habitats, lower spring water temperatures, an improved aquatic foodweb, and reduced effects of water diversions. Survival rates through the Bay-Delta should increase. Numbers of young salmon rearing in the Bay-Delta should increase with improved winter-spring flows and wetland habitats.

STEELHEAD TROUT: The vision for Central Valley steelhead trout is to recover this species listed as threatened under the ESA and achieve naturally spawning populations of sufficient size to support inland recreational fishing and the use fully existing and restored habitats. Steelhead will benefit from improved streamflows and riparian and shaded riverine aquatic habitat in the upper stream reaches. The vision is that restoration of ecological processes and habitats, along with a reduction of stressors, will contribute to stable and larger steelhead populations.

STRIPED BASS: The vision for striped bass is to maintain healthy populations, consistent with restoring native species, to their 1960s level of abundance to support a sport fisher in the Bay, Delta, and tributary rivers. The striped bass population will benefit from increased freshwater inflow to the Bay-Delta in late winter and spring, an improved aquatic foodweb, and reduced effects of water diversions. Improvements in water quality and reducing summer losses to diversions may be important in the long-term recovery of striped bass. Given the high reproductive capacity of striped bass, improvements in young production rates should be readily apparent when improvements are made to flow and foodweb, and when stressors are reduced.

GREEN STURGEON: The vision for green sturgeon is to recover this California species of special concern and restore population distribution and abundance to historical levels. Sturgeon populations should remain stable or increase with improved streamflows and aquatic foodwebs.

WHITE STURGEON: The vision for white sturgeon is to maintain and restore population distribution and abundance to historical levels. Sturgeon populations should remain stable or increase with improved streamflows and aquatic foodwebs.

AMERICAN SHAD: The vision for American shad is to maintain a naturally spawning population, consistent with restoring native species, that supports a sport fishery similar to the fishery that existed in the 1960s and 1970s. Central Valley American shad populations will benefit from improved spring freshwater inflow to the Bay-Delta and an improved Bay-Delta aquatic foodweb. Populations would be expected to remain stable or increase. Increases would be expected in dry and normal rainfall years.

NATIVE RESIDENT FISH SPECIES: The vision for native resident fish species is to maintain and restore the distribution and abundance of native species to contribute to overall species richness and diversity. Many native and non-native fish species will benefit from improved aquatic habitats and foodweb. Population abundance rates remain stable or increase. The distribution of native resident fishes should increase with widespread habitat restoration. The locally extinct Sacramento perch could be restored to new habitats in Suisun Marsh and the unique population of hardhead in the Napa River will be maintained.

LAMPREY: The vision for river lamprey is to maintain population abundance and distribution to contribute to the overall species diversity in the Napa River.

PACIFIC HERRING: The vision for Pacific herring is to maintain self-sustaining populations in order to support commercial fishing. With improved freshwater inflow to the North Bay and Suisun Marsh and more tidal emergent wetland and associated tidal perennial aquatic habitat, marine and estuarine fish and invertebrate population abundance and distribution would increase. Pacific herring survival and production in the North Bay should increase with an improved aquatic foodweb.

BAY-DELTA FOODWEB ORGANISMS: The vision for the Bay-Delta aquatic foodweb organisms is to restore the Bay-Delta estuary's once-productive food base of aquatic algae, organic matter, microbes, and zooplankton communities. Restoring the Bay-Delta foodweb organisms would require enhancing plankton growth and reducing loss of plankton to water exports, particularly in drier years. Several options exist for enhancing plankton growth. Improving Delta inflow and outflow in spring of drier years will be an essential element of any plan. Other

elements include reducing losses to exports from the system and reducing the amount of toxic substances entering the system. Probably the best way to improve the aquatic foodweb is to restore tidal marshes and the connectivity to tidal flows in addition to the restoration of freshwater flows since and important part of the food web was probably driven by detritus originating from nearby marshes. A key to achieving this vision is expanded support of basic research to define and better understand the important links between the aquatic foodweb and adjacent terrestrial or transitional wetland foodweb.

GRASS SHRIMP: The vision for grass shrimp is to maintain self-sustaining populations in order to support recreational and commercial fisheries.

SPECIAL STATUS PLANT SPECIES: The vision for special status plant species (Mason's lilaeopsis, Suisun Marsh aster, Suisun thistle, soft bird's-beak, Antioch Dunes evening-primrose, Contra Costa wallflower, bristly sedge, Point Reyes bird's-beak, delta mudwort, delta tule pea, and delta coyote-thistle) is to contribute to their recovery by protecting and preserving important habitats sites within the Bay-Delta.

CALIFORNIA FRESHWATER SHRIMP: The vision for California freshwater shrimp is to maintain existing population distribution and abundance of the this federally listed endangered species.

GIANT GARTER SNAKE: The vision for giant garter snake is to contribute to the recovery of this State and federally listed threatened species. Restoring aquatic, riparian, and wetland habitats in the Bay-Delta will aid giant garter snake and western pond turtle recovery.

WESTERN POND TURTLE: The vision for western pond turtle is to maintain and restore their abundance and distribution in order to contribute to overall species richness and diversity. Restoring aquatic, riparian, and wetland habitats in the Bay-Delta will aid giant garter snake and western pond turtle recovery.

SWAINSON'S HAWK: The vision for Swainson's hawk it to contribute to the recovery of this State and federally listed threatened species. Improvements in riparian and agricultural wildlife habitats will aid in the Swainson's hawk recovery. Increased sightings and possibly increased nesting would be expected in the Bay-Delta.

CALIFORNIA CLAPPER RAIL: The vision for California clapper rail is to contribute to the recovery of this State and federally listed threatened species. Restoring emergent wetlands in the North Bay and adjoining marshes should aid California clapper rail recovery. Population abundance and distribution should increase in the North Bay and adjoining marshes.

CALIFORNIA BLACK RAIL: The vision for California black rail is to contribute to the recovery of this State-listed threatened species. Restoring emergent wetlands in the North Bay and adjoining marshes should aid in California black rail recovery. Population abundance and distribution should increase in the North Bay and adjoining marshes.

SUISUN SONG SPARROW: The vision for the Suisun song sparrow is to recover this species of special concern in Suisun Marsh and the western Delta. The Suisun song sparrow abundance and distribution in the Suisun Marsh should increase with new tidal wetlands and improved riparian habitat in the marshes.

SAN PABLO SONG SPARROW: The vision for the San Pablo song sparrow is to maintain and restore the habitat of this species of special concern. The San Pablo song sparrow abundance and distribution should increase with new tidal wetlands and improved riparian habitat in the marshes.

SALTMARSH COMMON YELLOWTHROAT: The vision for the saltmarsh common yellowthroat is to contribute to the recovery of this species by maintaining and restoring habitat

SALT MARSH HARVEST MOUSE: The vision for the salt marsh harvest mouse is to contribute to the recovery of this State and federally listed endangered species through restoring salt marsh habitat in San Pablo and Suisun bays and adjacent marshes. New and improved salt marsh habitat in the North Bay and adjoining marshes will help in salt marsh harvest mouse recovery.

SAN PABLO CALIFORNIA VOLE: The vision for the San Pablo California vole is to contribute to the recovery of the species of special concern to contribute to overall species richness and diversity.

SUISUN ORNATE SHREW: The vision for the Suisun ornate shrew is to recover this California species of special concern to contribute to overall species richness and diversity.

SHOREBIRDS AND WADING BIRDS: The vision for the shorebird and wading bird guilds is to maintain and restore healthy populations through habitat protection and restoration, and reduction is stressors. Shorebirds and wading birds will benefit from wetland, riparian, aquatic, and agricultural habitats restoration. Seasonal use of the North Bay and adjoining marshes by these birds should increase.

WATERFOWL: The vision for waterfowl is to maintain and restore healthy populations at levels that can support consumptive (e.g., hunting) and nonconsumptive (e.g., birdwatching) uses consistent with the goals and objectives of the Central Valley Habitat Joint Venture and North American Waterfowl Management Plan. Many resident and migratory waterfowl species will benefit from improved aquatic, wetland, riparian, and agricultural habitats. Increase use of the North Bay and adjoining marshes and, possibly, increases in some populations would be expected.

DELTA GREEN GROUND BEETLE: The vision for the Delta green ground beetle is to contribute to the recovery of this federally listed threatened species by increasing their populations and abundance through habitat restoration.

NEOTROPICAL MIGRATORY BIRDS: The vision for the neotropical migratory bird guild is to restore and maintain healthy populations of neotropical migratory birds through restoring habitats on which they depend. Protecting existing and restoring additional suitable wetland, riparian, and grassland habitats will be critical to maintaining healthy neotropical migrant bird populations in the Bay-Delta. Large-scale restoration of nesting habitats will help reduce nest parasitism and predation by creating habitat conditions that render neotropical birds less susceptible to these stressors.

CALIFORNIA RED-LEGGED FROG: The vision for the California red-legged frog is to maintain populations of this federally listed threatened species. this vision will contribute to the overall species richness and diversity and to reduce conflict between protection for this species and other beneficial uses of land and water in the Bay-Delta. Protecting existing and restoring additional suitable aquatic, wetland, and riparian habitats and reducing mortality from non-native predators will be critical to achieving recovery of the California red-legged frog.

WESTERN LEAST BITTERN: The vision is to maintain western least bittern and its habitat throughout the Delta by protecting and restoring forage, nesting, and roosting habitats in conjunction with other habitat restoration actions.

INTEGRATION WITH OTHER RESTORATION PROGRAMS

Changing freshwater inflow patterns to the Bay, the major ecosystem process in the plan for the Delta, is a longstanding need; however, without developed supplies, the prescribed spring flow events and minimum freshwater inflows may not be available in all water-year types. In the short term, efforts will focus on providing the needed flows with available water supplies from the Central Valley Project (CVP) facilities at Shasta, Folsom, and New Melones Reservoirs using water prescribed by the Central Valley Project Improvement Act (CVPIA) and water purchased from willing sellers. The effectiveness of the water releases would be maximized through the use of tools such as water transfers. Property acquisitions with water rights from willing sellers are also a tool for acquiring water. In the long term, additional water supplies may be needed to meet remaining environmental needs.

Much of the infrastructure to implement the vision for the marsh and bay already exists. Restoration will be implemented through these existing programs. In areas where no cooperative agency and stakeholder efforts are underway, such organizations can be developed to help implement the program. To be successful, the restoration program must help to coordinate existing restoration programs being undertaken by State and federal resource agencies.

The recommendations in this plan will coincide with numerous programs and projects to protect and restore the Bay-Delta estuary. These programs are described below.